

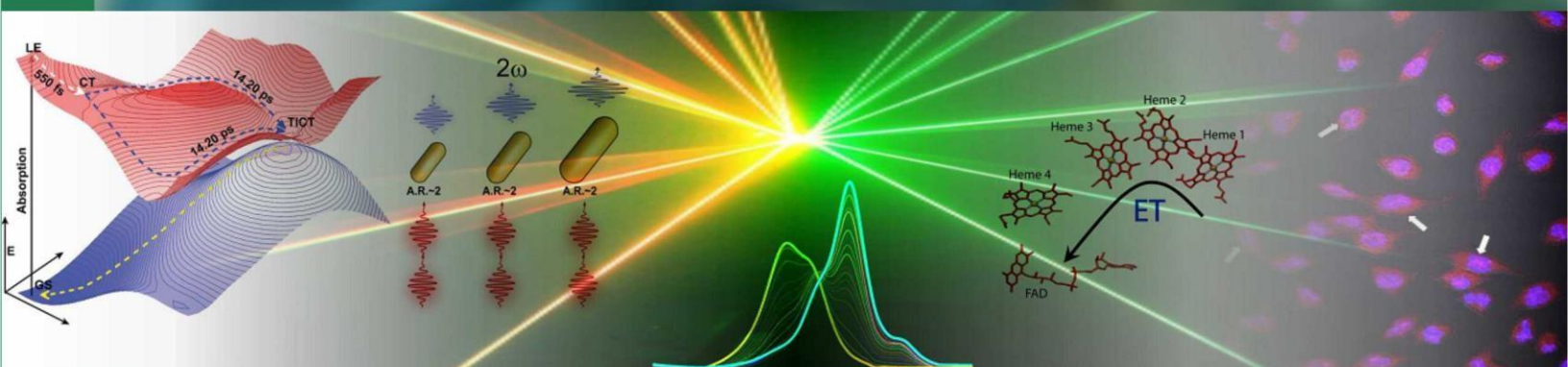


भारतीय प्रौद्योगिकी संस्थान कानपुर
Indian Institute of Technology Kanpur

CHEMISTRY

POST GRADUATE PROGRAM

Website: www.iitk.ac.in/chm



CHEMISTRY

The Department of Chemistry at the Indian Institute of Technology Kanpur is one of the premier teaching and research departments in the country. The Department started its journey in early nineteen sixties under the leadership of Professor C.N.R. Rao and maintained vigorous momentum under a galaxy of exceptionally gifted faculty members over these years. Altogether, they propelled the department forward and put it firmly on the path of excellence in modern chemistry teaching and research.

Over the years, the department has been able to maintain a steady growth by not only increasing visibility in academics, but also by leading in the chemical sciences research landscape in India. This has been made possible by the collective efforts of dedicated faculty members, motivated students and committed supporting staff. Since its inception, the department has attracted world class faculty, who are involved in research in all major areas of chemistry. Several of our faculty members are also engaged in interdisciplinary research spanning fields such as biology, physics and materials science. We offer a challenging environment for teaching and research in order to inculcate excellent working relationships with undergraduate and graduate students. The department has several state-of-the-art instruments to support cutting-edge research activities.

The Department of Chemistry has a Ph.D. programme designed to train candidates to pursue research of both fundamental and applied nature, and also to interact with other programmes of this Institute in a meaningful manner. The Department believes that the training of the students to a high level of professional competence for academic and industrial careers can be done best only in an environment where active research of high quality is being carried out. Accordingly, research forms one of the major activities of the Department.

The Department offers a Bachelor of Science (BS) program spanning four years, providing students with the flexibility to select courses tailored to their academic interests and needs. The curriculum encompasses fundamental disciplines such as chemistry, mathematics, physics, life sciences, as well as human and social sciences. Additionally, the department administers an Integrated BS-MS (Dual Degree) program. Furthermore, the department facilitates a Master of Science (M.Sc.) program through the Joint Admission Test for Masters (JAM). The Department consists of 40 Faculty members, about 300 Doctoral students, 20 post-doctoral and several project research associates. In addition, the department has about 95 Masters and 140 Undergraduate students.

POST-GRADUATE PROGRAMMES OFFERED

- ❖ Ph.D.
- ❖ M.Sc. (through JAM)

Lab Facilities

- ❖ The Department is equipped with large numbers of instrumental facilities. These include infrared, ultra-violet/visible and near infrared spectrophotometer, single crystal X-ray diffractometers with liquid nitrogen facility, various types of chromatographs, polarographs, cyclic voltammetry equipment, steady-state fluorimeter, circular dichroism, time-correlated single photon counting system, stopped flow apparatus, high speed centrifuge, ultracentrifuge, electrophoretic equipment, photochemical reactors and molecular modelling laboratory. The department has acquired two 400 MHz and one 500 MHz multinuclear NMR spectrometers, EI and ESI Mass spectrometers, Resonance Raman spectrophotometer, Mössbauer spectrometer, EPR spectrometer, Gas adsorption, CHNSO analyser, atomic force microscopy to augment research activities.
- ❖ The department also has access to the Institute's low-temperature laboratory, glass blowing and machine shops and various other analytical facilities in the institute. The department has a very good high performance computational facility and the department also has access to institute's computing facility.

FACULTY LIST

Inorganic Chemistry

- ❖ **Anantharaj Sengeni, Ph.D. (AcSIR, Karaikudi):** Electrocatalysis (HER, OER, ORR, NRR, CO₂RR, etc.), New Battery Chemistry, Electrochemical Sensors, Biosensors, Corrosion. Interfacial Electrochemistry, Surface Chemistry, and Advanced Materials for Energy Applications.
- ❖ **Apparao Draksharapu, Ph.D. (University of Groningen):** Bio-Inorganic Chemistry, Materials, Electrochemical Catalysis, HER and OER, Sensors, Photochemistry
- ❖ **Ashis K. Patra, Ph. D. (IISc Bangalore):** Lanthanide Chemistry, Medicinal Inorganic Chemistry, Photochemistry of Metal complexes, Optical Sensors
- ❖ **Basker Sundararaju, Ph.D. (Université de Rennes1, France):** Organometallic chemistry and Catalysis driven Organic Synthesis, Predictive catalysis using 3d Transition metals, Metallophotoredox catalysis, Artificial Metalloenzymes, Carbon Capture and Utilization, Asymmetric Catalysis and Molecular editing
- ❖ **Ganapathi Anantharaman, Ph.D. (Goettingen University):** Coordination polymers or Metal Organic Framework materials for Sorption, separation, and catalysis; Electronic and steric influences of main group compounds for catalysis and anion recognition.
- ❖ **Jitendra K. Bera, Ph.D. (IISc Bangalore):** Organometallics, 3d-metal catalysis, sustainable processes and products, metal-complexes as antibiotics
- ❖ **Namrata Singh, Ph.D. (IISc Bangalore):** Chemical Biology and Bioinorganic Chemistry, Bioinspired and Stimuli-Responsive Nanomaterials for Antimicrobial Applications, Nanomedicine for Cancer Therapy
- ❖ **Prakash C. Mondal, Ph.D. (University of Delhi):** Coordination Chemistry, Surface Chemistry, Interfacial Electrochemistry, Molecular Electronics and memory, Electrochromic and Supercapacitor Solid-State Devices
- ❖ **Raja Angamuthu, Ph. D. (Leiden University):** Evolution of molecules; bioinspired sequestration and activation of environmentally detrimental molecules; hydrides
- ❖ **Ritika Gautam Singh, Ph.D. (The University of Arizona):** Bioinorganic and Bioorganic Chemistry, Metal based site-selective drug design, Metals in Medicine, Drug Discovery
- ❖ **Sabuj K. Kundu, Ph. D. (Rutgers University):** Sustainable Catalysis and Organometallic Chemistry
- ❖ **Sankar P. Rath, (IACS, Kolkata):** Bioinorganic Chemistry, Artificial Metalloenzymes and Biocatalysis, Medicinal Inorganic Chemistry, Metalloporphyrins in Biology, Chemical Biology, Metal-based Drug Design

FACULTY LIST

Organic Chemistry

- ❖ **Anand Singh, Ph.D. (Vanderbilt University):** Synthetic Organic Chemistry, Visible light photocatalysis, Solar Photovoltaics, Fluorinated Organics
- ❖ **Dattatraya H. Dethe, Ph. D. (IISc Bangalore):** Total synthesis of bioactive natural products, new synthetic methods, Organic Synthesis, Asymmetric Catalysis, C-H activation, Medicinal Chemistry
- ❖ **Dharmaraja Allimuthu, Ph.D. (IISER Pune):** Synthesis of Organic molecules, medicinal chemistry, drug discovery, and Chemical biology
- ❖ **Gurunath Ramanathan, Ph.D. (IISc Bangalore):** Biochemistry, environmental biodegradation, fluorescence probes in biology
- ❖ **Jarugu N. Moorthy, Ph.D. (IISc Bangalore):** Organic photochemistry, mechanistic organic chemistry, organic synthesis and supramolecular chemistry
- ❖ **Maddali L. N. Rao, Ph.D. (University of Hyderabad):** Catalysis, Metal-catalyzed Coupling Reactions, Organometallic Organobismuth Chemistry, Organic Synthesis, Natural Products Synthesis, Green Chemistry & New Reactions Development.
- ❖ **Manas K. Ghorai, Ph.D. (NCL, Pune):** Asymmetric organic synthesis, synthetic methodology including transition metal catalyzed C-C and C-N bond formation, domino reactions, synthesis of biologically significant carba- and heterocycles, medicinal chemistry (drugs and related compounds) and material chemistry
- ❖ **Parthasarathi Subramanian, Ph.D. (IIT Bombay):** Synthetic Organic Chemistry, Total Synthesis of Natural Products, Asymmetric Synthesis, and Transition-Metal Catalysis for Medicinally/Biologically Relevant Molecules.
- ❖ **Ramesh Ramapanicker, Ph.D. (IISc Bangalore):** Synthetic organic chemistry, bioorganic chemistry
- ❖ **Ramkrishna Sarkar, Ph. D. (IISc Bangalore):** Organic synthesis of small molecules (monomers), Synthesis of polymers, Minimization of plastic waste, Development of sustainable polymer, hydrogel.
- ❖ **Sandeep Verma, Ph.D. (University of Illinois, Chicago):** New Antibiotics & AMR, Chemical Neuroscience, Stem Cell Engineering, Microfluidic Point-of-care Devices, Drug Design, Chemical Biology
- ❖ **Srinivas Dharavath, Ph.D. (University of Hyderabad):** Organic Chemistry, Medicinal Chemistry, Heterocyclic Chemistry, High Energy Density Materials, Energetic Oxidizers, Propelents. Iodine rich Compounds, Energetic Cocrystals, Energetic Ionic Liquids, Energetic MOF and COFs.
- ❖ **V. S. Mothika, Ph.D. (JNCASR, Bangalore):** Organic synthesis of small molecules, Chiral molecules; Heteroaromatics; Fluorescent organics; Porous polymers (CMPs, COFs); Chemical sensors
- ❖ **Vinod K. Singh, Ph.D. (M.S. University, Baroda):** Synthetic organic chemistry with particular emphasis on enantioselective reactions, synthesis of biologically active molecules

FACULTY LIST

Physical Chemistry

- ❖ **Amalendu Chandra, Ph.D. (IISc Bangalore):** Statistical mechanics and molecular simulations (classical, ab initio and quantum-classical) of liquids, surfaces, interfaces and biological systems; Theoretical spectroscopy and machine learning methods
- ❖ **Arnab Ghosh, Ph.D. (IACS, Kolkata):** Quantum statistical mechanics and Quantum thermodynamics (Theory)
- ❖ **Dasari L.V.K. Prasad, Ph.D. (University of Hyderabad):** Computational materials, solid state chemistry (theory)
- ❖ **Debabrata Goswami, Ph.D. (Princeton University):** Femtochemistry, optical trapping, biomedical applications, Thermal spectroscopy, nonlinear spectroscopy, multiphoton imaging, femtosecond pulse shaping, coherent control, quantum computing
- ❖ **Devendra Mani, Ph. D. (IISc Bangalore):** Vibrational spectroscopy, High-resolution gas phase spectroscopy, Helium nanodroplets, Chemical reactions at ultracold temperatures, Non-covalent interactions
- ❖ **Keshavamurthy Srihari, Ph.D. (University of California, Berkeley):** Semi classical methods in chemistry (Theory)
- ❖ **Madhav Ranganathan, Ph.D. (Stanford University):** Modelling and simulation of semiconductors and 2D materials
- ❖ **Mainak Sadhukhan, Ph.D. (IISER Kolkata):** Time-dependent quantum mechanics, Development and applications of accurate electron structure methodologies, Orbital-free density functional theory
- ❖ **Manabendra Chandra, Ph. D. (IISc Bangalore):** Nanoscale plasmonics; Plasmon photocatalysis; Single-particle spectroscopy & imaging; Strong coupling; Nano-bio interfaces; Antimicrobial resistance
- ❖ **Nagma Parveen, PhD (University of Muenster):** Biological nanoparticles, Virus- membrane interactions, Surface functionalization, Binding kinetics, Fluorescence imaging
- ❖ **Nishanth N. Nair (University of Hannover, Germany):** Computational chemistry, computational catalysis, computational biology, molecular dynamics simulations, density functional theory
- ❖ **Pratik Sen, Ph.D. (IACS Kolkata):** Ultrafast laser spectroscopy; Fluorescence spectroscopy; Single molecule spectroscopy; Perovskite stability, carrier dynamics and catalysis; Ultrafast intersystem crossing; Room temperature phosphorescence; Enzyme activity-dynamics relation.
- ❖ **Thiruvancheril G. Gopakumar, Ph. D (Technical University of Chemnitz, Germany):** Molecular thin films, molecular switches and gates, 2D materials based on molecules, application of molecular materials in electronic devices. chemistry at surfaces and interfaces, scanning tunneling microscopy, atomic force microscopy, solid state.
- ❖ **Vishal G. Rao, Ph.D. (IIT Kharagpur):** Perovskite stability, photocatalysis, and photovoltaics; Plasmonic photocatalysis; interfacial charge transfer dynamics; strategies for efficient solar energy utilization; and carbon dioxide reduction into hydrocarbon fuels.

BROAD RESEARCH AREAS

Inorganic Chemistry

The research interests of inorganic section span diverse areas that include coordination chemistry, bioinorganic chemistry, organometallic chemistry, catalysis, and supramolecular chemistry. The study of inorganic entities in biological systems is also a major topic of interest, which includes studies on heme centers in heme protein and topics related to medicinal inorganic chemistry. The creation of new chemical entities with interesting structures, optical, magnetic and electrochemical properties for applications in catalysis and functional material chemistry is also being pursued in many laboratories.

Organic Chemistry

Research areas in organic chemistry include an eclectic mix of traditional and contemporary fields such as bioorganic chemistry, new reaction development, natural product synthesis, photochemistry, chemical biology, organic materials and catalysis. In addition to studying the chemistry of small molecules, the synthesis and application of carbohydrate and peptide based architectures and metal-organic frameworks for applications in medicine and material science are also being performed in a number of laboratories. Many laboratories are engaged in interdisciplinary research wherein chemical synthesis of new molecules is guided by their applications as modulators of biological function or as potential new catalysts and materials. Investigations of mechanistic basis of organic photo and thermal reactions and development of organic functional materials based on de novo approaches are actively pursued.

Physical Chemistry

Research areas in the domain of physical chemistry encompass computational and theoretical chemistry, reaction dynamics, spectroscopy, and materials chemistry. Specific areas include fundamental gas phase molecular dynamics, statistical mechanics, and the application of modern techniques like ultrafast pulse-shaping, molecular beams, single molecule spectroscopy and imaging, and fluorescence. Modern research problems are increasingly becoming multifaceted, and require research efforts that encompass more than one field of science. Our department has a number of laboratories involved in investigating such problems that lie on the interface of two disciplines, and incorporate research from synthetic chemistry, biological sciences, material sciences, medicinal chemistry, and drug discovery correlation and up-conversion to study challenging problems involving electronic structure and dynamics. Both experimental and theoretical research components are strongly represented, and many research programs amalgamate a variety of techniques to answer fundamental questions.

BROAD RESEARCH AREAS

Inter-disciplinary Research

Modern research problems are increasingly becoming multifaceted, and require research efforts that encompass more than one field of science. Our department has a number of laboratories involved in investigating such problems that lie on the interface of two disciplines, and incorporate research from synthetic chemistry, biological sciences, material sciences, medicinal chemistry, and drug discovery.





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